AMP-155-95

NO REMEDIAL ACTION/NO FURTHER REMEDIAL ACTION (NFA) DECISION CRITERIA FOR ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE AND MEMORANDUM OF UNDERSTANDING

draft

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MEMORANDUM OF UNDERSTANDING

It is the understanding of the undersigned that the No Remedial Action/No Further Remedial Action (NFA) Decision Criteria presented herein will be used as guidance for determining which Individual Hazardous Substance Sites (IHSSs), Source Areas (SAs), Operable Units (OUs), or Areas of Concern (AOCs) at the Rocky Flats Environmental Technology Site (RFETS) may become candidates for an NFA decision. These NFA decision criteria meet the requirements set forth in the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) for No Action or No Further Action decisions. Further, these criteria provide a process for fulfilling the site-closure requirements under the Resource Conservation and Recovery Act (RCRA), as administered through the Colorado Hazardous Waste Act (CHWA) for those RCRA-lead IHSSs. It is also the understanding of the undersigned that this document may be amended as required by changes in the regulatory environment or as the NFA process evolves.

APPROVED BY THE RFETS QUALITY ACTION TEAM:

U.S. Department of Energy Date

U.S. Environmental Protection Agency, Region VIII Date

Colorado Department of Public Health and Environment Date

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LIST OF ACRONYMS AND INITIALISMS

AOC	Area of Concern
ARAR	Applicable or Relevant and Appropriate Requirement
BRA	Baseline Risk Assessment
CAD/ROD	Corrective Action Decision/Record of Decision
CDPHE	Colorado Department of Public Health and Environment
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CHWA	Colorado Hazardous Waste Act
CHWR	Colorado Hazardous Waste Regulations
COC	Chemical of Concern
DOE	Department of Energy
ECOC	Ecological Chemical of Concern
EPA	Environmental Protection Agency
ERA	Ecological Risk Assessment
ERAM	Ecological Risk Assessment Methodology
HHRA	Human Health Risk Assessment
HI	Hazard Index
HQ	Hazard Quotient
HRR	Historical Release Report
IAG	Interagency Agreement
IHSS	Individual Hazardous Substance Site
IM/IRA	Interim Measure/ Interim Remedial Action
NCP	National Contingency Plan
NFA	No Remedial Action/No Further Remedial Action
OU	Operable Unit
PCOC	Potential Chemical of Concern
RAGS	Risk Assessment Guidance for Superfund
RBCs	Risk-Based Concentrations
RCRA	Resource Conservation and Recovery Act

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RFETS	Rocky Flats Environmental Technology Site
RFI/RI	RCRA Facility Investigation/Remedial Investigation
RME	Reasonable Maximum Exposure
SA	Source Area
SWMU	Solid Waste Management Unit
TM	Technical Memorandum
UTL	Upper Tolerance Limit

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EXECUTIVE SUMMARY

Presented in this document are No Remedial Action/No Further Remedial Action (NFA) decision criteria and NFA decision documentation requirements to be used as guidance for determining the applicability of an NFA decision to sites (e.g., Individual Hazardous Substance Sites [IHSSs], Source Areas [SAs], Operable Units [OUs], Areas of Concern [AOC]) at the Rocky Flats Environmental Technology Site (RFETS), Golden, Colorado.

The NFA decision process presented within this document meets the substantive requirements to support a No Action or No Further Action (as defined by CERCLA) remedy selection for a Corrective Action Decision/Record of Decision (CAD/ROD). In addition, administrative requirements for coordination of NFA decisions with the CAD/ROD process and with RCRA closures at RFETS are discussed in this document. Individual steps within the NFA decision process which have been consolidated in this document have already been successfully used at RFETS and have been referenced from EPA guidance documents, the Interagency Agreement, and EPA and CDPHE-RFETS-specific guidance (e.g., letters). The steps, in order of performance, can be summarized as follows:

1. Conduct source evaluation (with available data/information). If a review of historical release information/data reveals that no existing source can be found, the exposure pathway is incomplete and the IHSS can be recommended for NFA.

2. Conduct a background comparison. If a review of historical release information/data indicates that a contaminant source may be present, an IHSS, usually as part of an OU, will undergo a background comparison. A background comparison is performed to distinguish between constituents that are associated with site activities and those associated with background conditions. If medium-specific environmental data collected from an IHSS are shown to be at or below background levels for inorganic chemicals, and no organic chemicals are detected in that medium, that IHSS may become a candidate for NFA.

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3. Conduct a CDPHE conservative screen. The purpose of conducting a CDPHE conservative screen is to reduce the number of IHSSs that are required to undergo a CERCLA baseline risk assessment. For OUs currently in the RCRA Facility Investigation/Remedial Investigation (RFI/RI) process, human health risks have already been screened using the CDPHE conservative screen. Ecological risks are screened using Tier 2 of the Ecological Risk Assessment (ERA) process. If an IHSS or source area passes both the human health and ecological risk-based screens, then that IHSS becomes a candidate for NFA.

4. Perform a Baseline Risk Assessment (BRA). The BRA consists of a human health risk assessment (conducted on an exposure area) and an ecological risk assessment (conducted by drainage area). If the results of the BRA estimate that the risks to human health and the environment are within acceptable levels, the IHSS becomes a candidate for NFA.

The remedy selection process must be documented to support a NFA decision. For those sites not evaluated as part of an RFI/RI, a document justifying the NFA decision must be prepared to present an evaluation of existing information and data to support a scientifically and legally defensible NFA decision. For those sites evaluated within an RFI/RI Report or a Letter Report (i.e., a report generated as part of the CDPHE conservative screen), a document justifying the NFA decision is not necessary. Rationale for an NFA decision will be summarized in an update to the Historical Release Report (HRR), and appropriate supportive documentation will be appended, as necessary. The HRR update for an NFA is intended to be a place keeper for documentation that the substantive requirements for an NFA decision have been met.

This guidance is intended to make the NFA decision-making process simple and clear. Similarly, NFA documents should be as concise as possible. Defining the NFA decision-making process should rely on existing, easily obtainable data.

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1.0 INTRODUCTION

1.1 Objectives

The purpose of this document is to present guidance for formal approval by the Colorado Department of Public Health and Environment (CDPHE), the U.S. Environmental Protection Agency (EPA), and the U.S. Department of Energy (DOE) for implementing the process for determining those sites (e.g., Individual Hazardous Substance Sites [IHSSs], Source Areas [SAs], Operable Units [OUs], Areas of Concern [AOCs]) at the Rocky Flats Environmental Technology Site (RFETS), Golden, Colorado for which a No Remedial Action/No Further Remedial Action (NFA) decision is applicable. Various processes that meet the substantive requirements in support of NFA remedy selection have been consolidated in this document to support adoption of the NFA Corrective Action Decision/Record of Decision (CAD/ROD) process at RFETS.

Presented in this document are NFA decision criteria and requirements for NFA decision documentation that ultimately can be used in the preparation of a CAD/ROD or in a RCRA closure. Administrative requirements for coordination of NFA closures at RFETS are discussed briefly in the Section 3.0 on NFA decision documentation. The primary benefits for having a preapproved NFA decision process include the following:

- Accelerate IHSS decision making and closures by not having to redevelop the NFA process for each closure.

  Track the status of successful closures at RFETS more accurately on an IHSS-by-IHSS basis. With each IHSS, SA, AOC, or OU that has been documented as acceptable for an NFA decision (e.g., that no unacceptable risk exists in that area), support for the eventual closure of RFETS will grow.

  Eliminate negative cost and schedule impacts. Once an area has been accepted for an NFA decision, any work that is scheduled to occur within that area (e.g., routine monitoring or maintenance) should not require all the paperwork (e.g., Soil Disturbance Permit, waste deteminations, etc.) or the personal protective equipment that would be needed in a contaminated (real or suspected) area. This would save time and money, and reduce the amount of waste generated.

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- Limit the number and length of documents to be produced, thus reducing review time and cost of document production.
- Accelerate cleanup at RFETS by allowing resources to be directed to high priority sites.

Another objective of this document is to provide a basis for establishing a Working Group for NFA Strategy. One of the primary goals for this NFA working group would be to define the geographic areas (i.e., IHSS, SA, AOC, or OU) that will be considered for the NFA determination process.

1.2 Regulatory Basis for NFA Decisions

On January 22, 1991, the DOE, the CDPHE, and the EPA entered into a tri-party agreement (Interagency Agreement [IAG]), as directed by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the corrective action section of the Resource Conservation and Recovery Act (RCRA), for the management of Rocky Flats Facility cleanup. This agreement was made to ensure that: (1) environmental impacts associated with past and present activities at the Rocky Flats Site would continue to be thoroughly investigated; (2) appropriate response actions would be taken and (3) response actions would be completed as necessary to protect human health, welfare, and the environment. This framework identified the necessity of joint environmental regulatory processes to fulfill the requirements of RCRA and CERCLA. The IAG identified the required methodology for remedial actions, permit modifications, closures, and corrective actions for cleanup at Rocky Flats. This NFA decision criteria document expands on the site-specific methodology for making NFA decisions at RFETS, using the regulatory guidance provided by CERCLA and RCRA.

1.2.1 CERCLA Guidance

Section 117 of CERCLA, as amended by SARA of 1986, requires the issuance of decision documents for remedial actions taken pursuant to sections 104, 106, 120, and 122. In response to these regulations, the EPA developed *Guidance on Preparing Superfund Decision Documents, Preliminary Draft* (EPA, 1992) and a Quick Reference Fact Sheet titled *Guide to*

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Developing Superfund No Action, Interim Action, and Contingency Remedy RODs (EPA, 1991a). EPA has also produced a *Record of Decision Checklist for No Action* (EPA, undated) to aid in the development of NFA decision documents and in the process of obtaining an NFA decision. EPA OSWER Directive 9355.0-30 (EPA, 1991b) was written to clarify the role of the baseline risk assessment in developing Superfund remedial alternatives and supporting risk management decisions. These documents are the basis upon which this current NFA decision criteria document for RFETS is built.

From the NFA Quick Reference Fact Sheet (EPA, 1991a), a no-action decision may be warranted under three general sets of circumstances:

1. When the site or a specific problem or area of the site (e.g., an OU or an IHSS) poses no current or potential threat to human health or the environment (a no-action decision);
2. When CERCLA does not provide the authority to take remedial action; or
3. When a previous response eliminated the need for further remedial response (a no-further-action decision).

EPA (EPA, 1992) defines no action as "no treatment, engineering controls, or institutional controls." "Remedial alternatives that include solely institutional controls are not considered "no action." An alternative may include monitoring and still be considered "no action."

OSWER Directive 9355.0-30 (EPA, 1991b) states that: "If the baseline risk assessment and the comparison of exposure concentrations to chemical-specific standards indicates that there is no unacceptable risk to human health or the environment and that no remedial action is warranted, then the CERCLA Section 121 cleanup standards for selection of a Superfund remedy, including the requirements to meet applicable or relevant and appropriate requirements (ARARs), are not triggered."

1.2.2 RCRA Guidance

A RCRA corrective action is used to clean up hazardous waste or hazardous waste constituents released from any solid waste management unit (SWMU) at a permitted facility, as codified in 42 USC 6924 section 3004(u).

The State of Colorado was authorized, by the EPA, to manage hazardous waste requirements within its boundaries through the Colorado Hazardous Waste Act (CHWA). CDPHE, through its Hazardous Material and Waste Management Division, promulgated regulation in 6 CCR 1007-3 for the proper handling of hazardous waste and constituents. The Corrective Action Program for any SWMU is defined in section 264.101 of those regulations.

On November 16, 1993, CDPHE provided additional guidance for closure requirements, corrective action requirements, and other program requirements. This guidance identified the risk assessment methodology and the use thereof in making corrective action decisions for hazardous waste generator facilities that are regulated by the CHWA and its implementing regulations (Colorado Hazardous Waste Regulations [CHWR]). The methodology identifies a three-step screen approach for evaluating corrective action at a SWMU. This screen deals solely with hazardous constituents identified in CHWR regulations 1007-3 section 261.

The first screen is a comparison to background and/or detection limits. Exceeding the detection limits or background levels (both defined in this guidance) would require screening steps two and three. SWMU or release sites that meet the levels prescribed in the criteria identified are considered "clean" and corrective action would not be necessary.

In addition, the July 27, 1990, Federal Register proposes 40 CFR §264.514, which presents a mechanism by which a permittee may request a permit modification to effectively terminate further requirements at a RCRA facility where no further action is justified.

For IHSSs that have interim status under RCRA, the closure process is defined within correspondence to DOE from CDPHE (1992). Substantive requirements were to be included as part of an Interim Measure/Interim Remedial Action (IM/IRA) and Closure Plan combined document for public comment. However, for NFAs, an IM/IRA may not be required. In this case, the Closure Plan could be included as a combined Proposed Plan/Closure Plan for public comment. In this situation, modification of the CHWA Permit for Rocky Flats may have to proceed as a separate process after the CAD/ROD is adopted. For interim status units (e.g., IHSSs), RCRA Clean Closure Certification by an independent engineer is a requirement for NFA.

1.3 Exposure Pathway—Generic Site Conceptual Model

The key criterion in proposing an NFA decision is the determination of whether any actual or potential risk to human health or the environment exists. In order for a public health or environmental threat to exist, a complete pathway for exposure must exist between a site and a receptor. Individual components of an exposure pathway from the generic site conceptual model for the *No Further Action Justification Document for Rocky Flats Plant Low-Priority Sites (Operable Unit 16)* (DOE, 1993) are shown in Figure 1.

An exposure pathway is defined as "a unique mechanism by which a population may be exposed to chemicals at or originating from the site" (EPA, 1989a). As shown in Figure 1, a credible exposure pathway must include a contaminant source, a release mechanism, a transport medium, an exposure route, and a receptor. These individual components of an exposure pathway are defined as follows:

- Contaminant Source: A contaminant source includes contaminants and/or contaminated environmental media associated with historical operations/occurrences at each IHSS.

- Release Mechanisms: Release mechanisms are physical and chemical processes by which contaminants are released from the source. A conceptual model identifies primary release mechanisms, which release contaminants directly from the IHSSs, and secondary release mechanisms, which release contaminants from environmental media.

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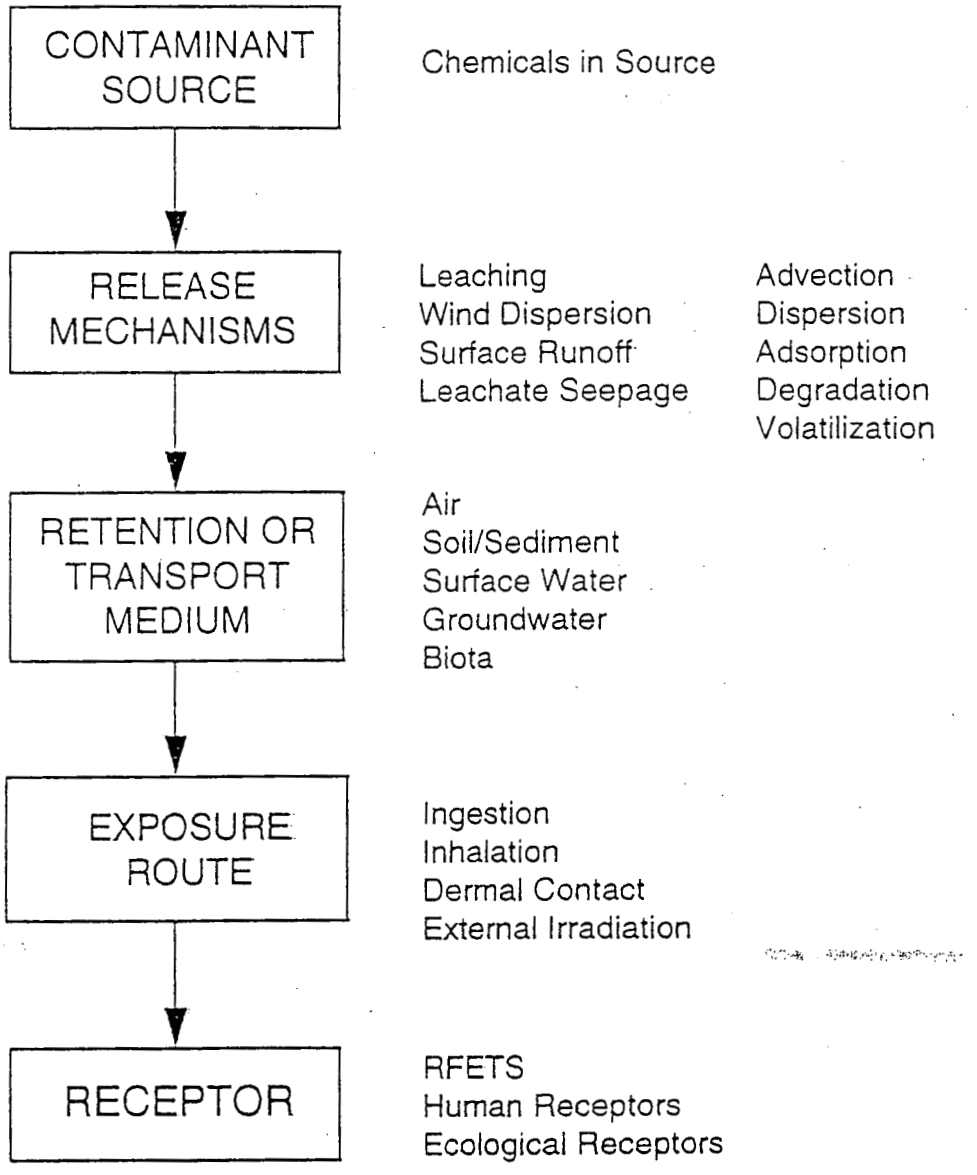

Figure 1. Exposure Pathway--Generic Site Conceptual Model

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- Retention or Transport Medium: A retention or transport medium is one into which contaminants are released from the source and from which contaminants may be released to a receptor (or to another medium by a secondary release mechanism). Primary transport media include air, soil, surface water, ground water, and biota.

- Exposure Route: An exposure route is an avenue through which contaminants are physiologically incorporated by a receptor and include inhalation, ingestion, dermal contact, and external irradiation.

- Receptor: A receptor is a population affected by contamination released from a site. Potential human receptors for contaminants in IHSSs at RFETS include workers and visitors. Environmental receptors include flora and fauna. Offsite receptors could include residents or agricultural workers.

If an exposure pathway lacks any of these components, it is not complete, there is no risk, and NFA is warranted. However, if an exposure pathway is complete, an NFA can be considered if the potential risk present is within acceptable limits. The criteria for NFA decisions presented in Section 2 address both incomplete and complete exposure pathways. Section 3 describes the documentation requirements for making an NFA determination.

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2.0 CRITERIA FOR NFA DECISIONS

The regulatory process for dispositioning a site suspected of contamination can be long and complex. However, there are several points in this process at which an IHSS, SA, AOC, or OU can be recommended for NFA. Criteria have been developed for each decision point to determine whether or not sufficient information is available to protect human health and the environment. Figure 2 shows these NFA decision points. The remainder of this section, which is organized according to Figure 2, describes the criteria to be met at each decision point.

2.1 Source Evaluation

The first step in evaluating a site is to determine what sources of contamination, if any, remain in an IHSS. If no existing source can be found, the exposure pathway is incomplete and the IHSS can be recommended for NFA. The remaining components of an exposure pathway (release mechanisms, retention or transport medium, exposure route, and receptor) are all evaluated during the risk assessment process.

The NFA criteria for demonstrating a lack of contaminant source are site specific. Historical information must be reviewed to determine whether or not an NFA decision may be appropriate at an early stage of a site investigation. NFA justification can be accomplished using minimal investigation and characterization resources if adequate historical release information and data are available; additional environmental sampling may not always be necessary. If it appears that an existing contaminant source is lacking in an IHSS, an NFA determination may be made without the need to collect additional environmental samples (Decision Point 1).

As seen in Figure 2, an NFA recommendation at Decision Point 1 may be made under at least three circumstances, where a lack of contaminant source is indicated. These circumstances have already resulted in successful NFA determinations for IHSSs at RFETS. The final *No Further Action Justification Document (NFAJD) for OU16* (DOE, 1993) describes these circumstances, which are demonstrated in the following examples:

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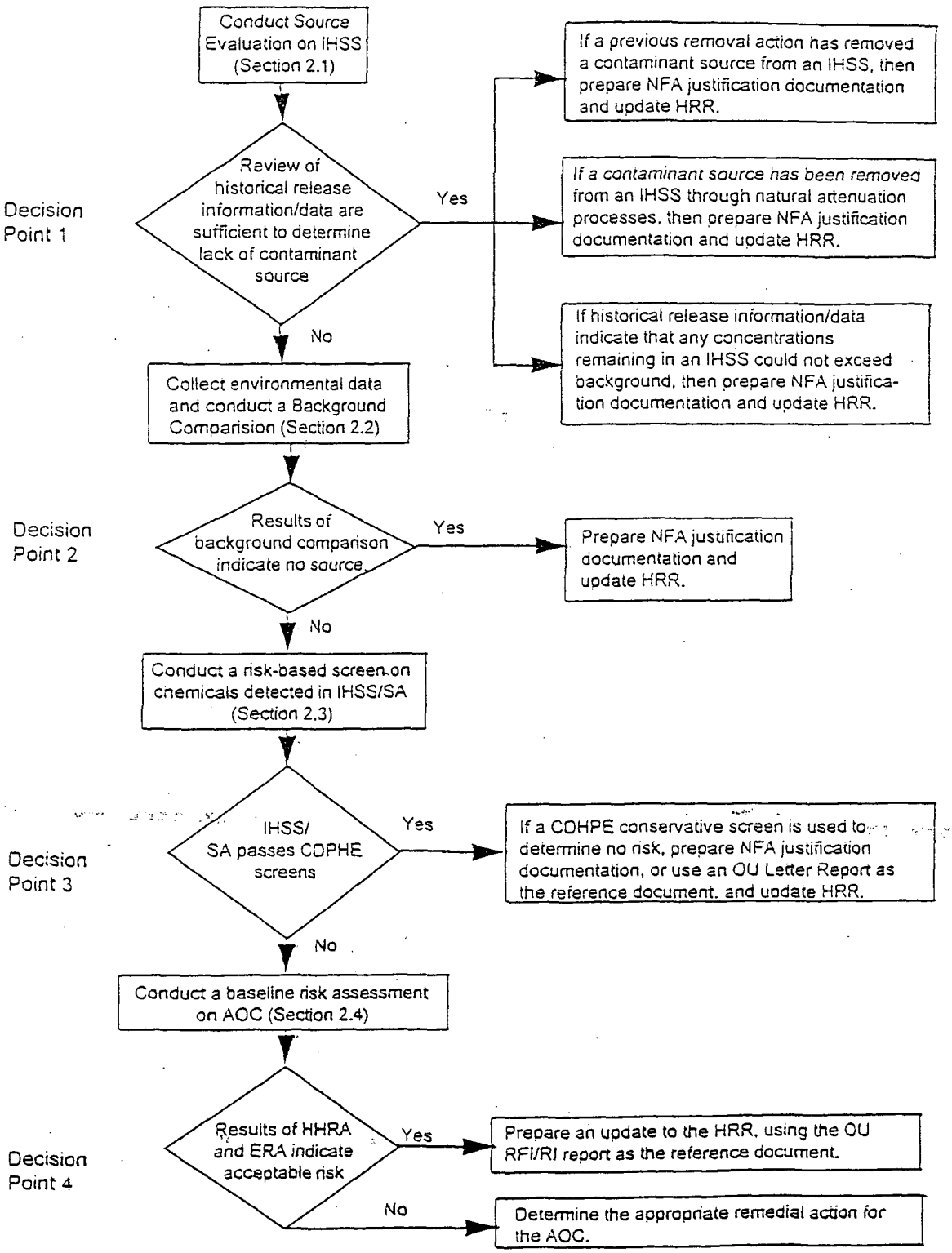

Figure 2. Decision Points for NFA Recommendations

1. In IHSS 185, a 1986 4-gal solvent spill was cleaned up immediately, using a commercial absorbent. This solvent was not detected in subsequent groundwater sampling. Based on this evidence and additional physicochemical rationale, no action was warranted for this IHSS.

2. In early 1980, 155 gallons of antifreeze, containing 25 percent ethylene glycol, were released from Building 708 through a buried culvert (IHSS 192) into Walnut Creek. A fate and transport degradation model run using the physicochemical characteristics of ethylene glycol indicated that it was completely degraded through natural attenuation, resulting in an NFA decision for this IHSS.

3. A 1979 break in a steam condensate line discharged steam condensate water containing low levels of tritium onto a paved area (IHSS 194). Tritium levels in steam condensate water samples were within background activity levels; considering the half life of tritium and the time since the discharge, no action was warranted.

As with the IHSSs in OU16, this type of NFA determination may be useful for evaluating IHSSs in the Industrial Area at RFETS. However, if adequate historical release information and current environmental data are not available to make an NFA determination, an IHSS would be progressed to the next step in the process, which could include scoping the site investigation to obtain additional data.

2.2 Background Comparisons

If a review of historical release information/data indicates that a contaminant source may be present, an IHSS, usually as part of an OU, will undergo a background comparison. A background comparison is performed to distinguish between constituents that are associated with site activities and those associated with background conditions. If sufficient data are available, a statistical methodology is used to conduct the background comparison (i.e., potential chemicals of concern [PCOC] identification) for nonanthropogenic compounds. A five-phase methodology (Figure 3), used to determine if an inorganic constituent exceeds background levels, was developed and approved by DOE, EPA Region VIII, and CDPHE. This methodology is detailed in the *Human Health Risk Assessment Methodology for RFETS* (DOE, 1995a) and EG&G Interoffice Correspondence (EG&G, 1995). In addition, examples of the

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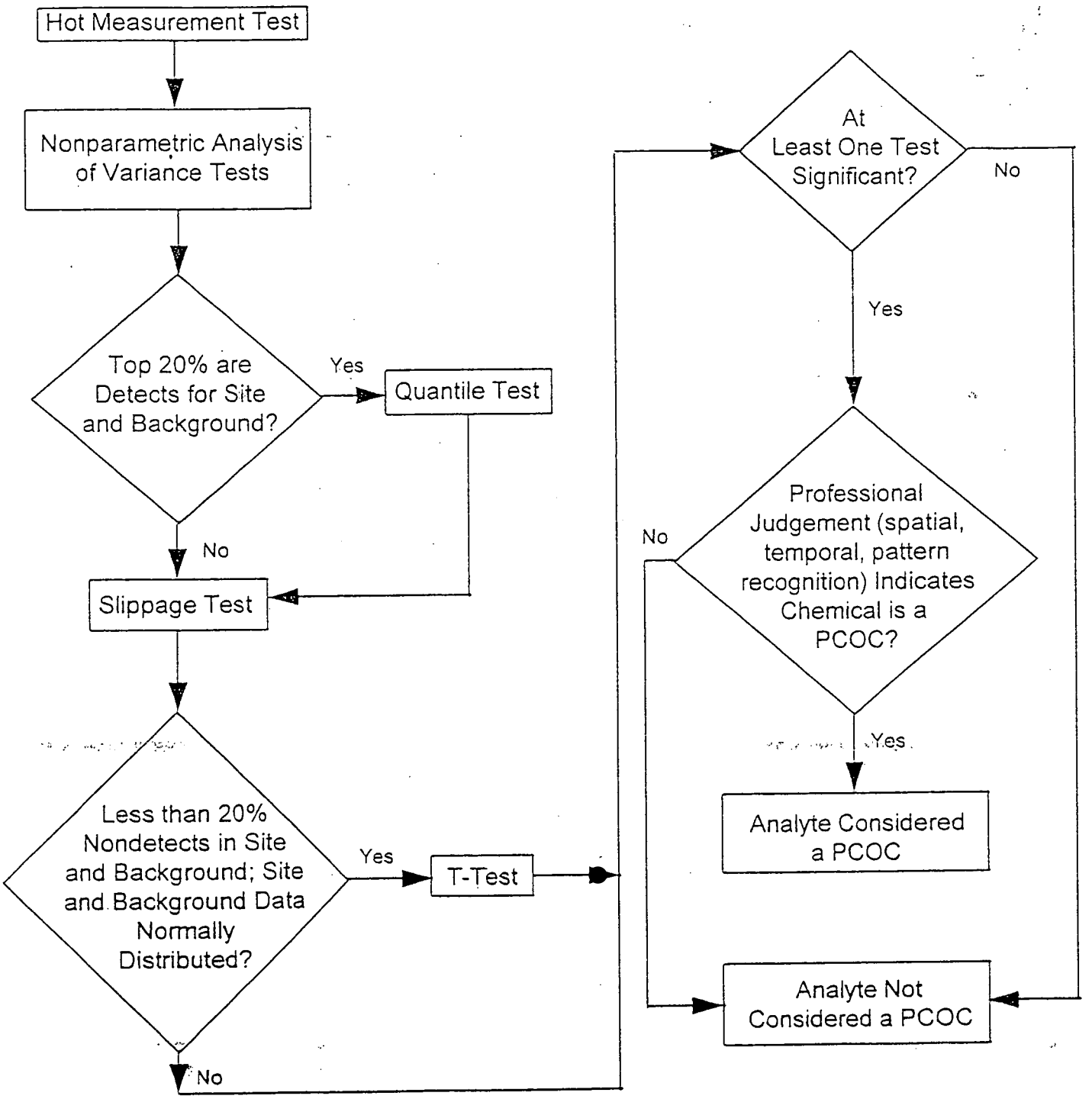

Figure 3. Background Comparison/PCOC Selection

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application of background comparison at RFETS can be found in the site-specific letter reports for OU5 (DOE, 1994a) and OU6 (DOE, 1994b).

In a statistical background comparison, PCOCs are determined on an OU-wide basis for each environmental medium. Organic chemicals are assumed to be man-made and are not compared to background. Professional judgement, using spatial, temporal, or pattern-recognition concepts, must be applied to ensure the background data set is appropriate for comparison to the OU data set (for example, geologic conditions should be considered). If appropriate background data sets are not available (such as with OU3 lake sediments), a weight-of-evidence approach may be used to provide background benchmark values. Professional judgment must also be used to identify IHSSs or OUs where analyte- or medium-specific data are insufficient to run statistical background comparisons (e.g., in data sets with limited sample size or greater than 80% nondetects). In these cases, it may be more appropriate to use only the Hot Measurement Test (i.e., the maximum detected concentration of an analyte is compared to the background 99% upper tolerance limit [$UTL_{99/99}$] for that analyte) as a background comparison.

If medium-specific environmental data collected from an IHSS are shown to be at or below background levels for inorganic chemicals, and no organic chemicals are detected in that medium (Decision Point 2), that IHSS may become a candidate for NFA. If PCOCs are identified for an IHSS, the data must be analyzed using the CDPHE conservative screen described in Section 2.3.

2.3 Risk-based Screening of Chemicals

An IHSS having PCOCs (inorganic and/or organic), as indicated through a background comparison described in Section 2.2, must undergo a risk-based screening of chemicals before it can be recommended for no action. The purpose of conducting a risk-based screen is to reduce the number of IHSSs that are required to undergo a CERCLA baseline risk assessment. Human health risks are evaluated using the CDPHE conservative screen (Section 2.3.1);

ecological risks are screened using Tier 2 of the ecological risk assessment (ERA) process (Section 2.3.2).

2.3.1 CDPHE Conservative Screen

The CDPHE conservative screen was developed by the State of Colorado to ensure that the requirements of RCRA are met. The CDPHE conservative screen was incorporated by DOE, EPA, and CDPHE into the data aggregation process used in human health risk assessment (HHRA) for RFETS. This screen is one method used by DOE, EPA, and CDPHE to make decisions regarding no action, voluntary corrective action, or further analysis through an HHRA. A CDPHE conservative screen is conducted in accordance with the guidance provided in the *Human Health Risk Assessment Methodology for RFETS* (DOE, 1995a) and shown in Figure 4.

In the CDPHE conservative screen, SAs are delineated that contain organic PCOCs above reporting limits and/or inorganic PCOCs at concentrations above the arithmetic mean plus two standard deviations of the background data. An SA consists of one or more IHSSs that are grouped together based on historical use, site characterization, PCOC types and concentrations, affected media, and rates of migration.

The CDPHE conservative screen is considered conservative based on the following requirements of the process:

- The risk-based concentrations (RBCs) ratio sum for each SA is calculated using the maximum detected concentration for an analyte, rather than the 95% upper confidence limit used in CERCLA risk assessments.

- The chemical- and medium-specific RBC is calculated assuming direct residential exposure, rather than an exposure scenario more appropriate to the site. Land use recommendations made by the Rocky Flats Future Site Working Group (1995) primarily include open space use for the buffer zone and environmental technology (industrial/ office) use for the industrial area; future onsite residential land use was not recommended.

- The RBC is calculated using a carcinogenic risk of 10E-6 and a noncarcinogenic hazard quotient of 1.0, rather than using the 10E-4 to 10E-6 risk range used in CERCLA risk assessments.

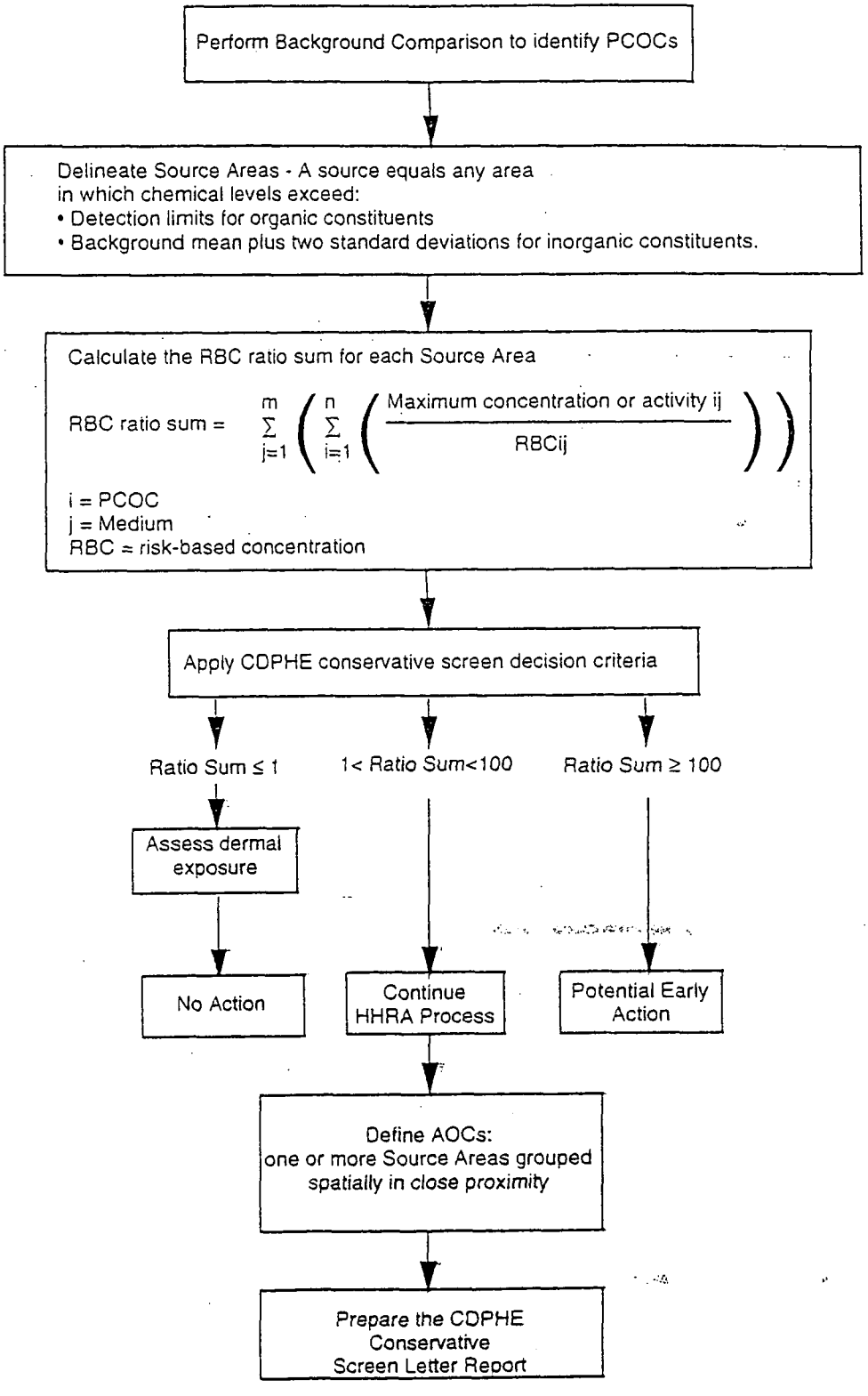

Figure 4. CDPHE Conservative Screen

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- The residential scenario is based on exposure assumptions and standard default factors provided for the reasonably maximum exposed (RME) residential receptor; CERCLA risk assessments also provide risk estimates for central tendency (average) receptors.

- The CDPHE conservative screen includes data for soil samples collected to a depth of 12 feet in the surface soil calculations, rather than soil from the 0- to 2-foot interval, which is more typical of CERCLA HHRAs.

The chemical-specific ratios are summed for each medium, with carcinogenic ratios summed separately from those analytes causing noncarcinogenic effects. The ratio sums for each medium are then added to get a total sum ratio for an SA. The ratios are compared to the CDPHE conservative screen decision criteria used to designate source areas as candidates for no action, for further evaluation in the HHRA, or for possible early action (Decision Point 3). Source areas with ratio sums less than 1 may become candidates for NFA pending an evaluation of the risk associated with potential dermal contact. For source areas with ratio sums between 1 and 100, and greater than 100, DOE may evaluate the source area further in the HHRA and/or pursue a voluntary early action alternative, respectively. A CDPHE conservative screen letter report is prepared to summarize the results of this screen and is used as a reference document to justify an NFA decision.

Those IHSSs or SAs within an OU that do not pass the CDPHE conservative screen are grouped into areas of concern (AOCs) for further evaluation in an HHRA. AOCs are defined as one or more SAs grouped spatially in close proximity that have historically similar waste streams (i.e., similar PCOCs).

2.3.2 Ecological Risk Assessment Tier 2 Screen

After an IHSS or source area passes the CDPHE conservative screen, it must then pass a screening level ERA before it can become a candidate for an NFA decision. This screening process is performed according to the EPA's eight-step guidance (draft) on conducting ERAs at Superfund sites (EPA, 1994). To ease the preparation of ERAs at RFETS, a sitewide ecological risk assessment methodology (ERAM) has been developed which is consistent with this eight-step guidance (EPA, 1994).

The first two steps of the EPA process, shown in Figure 5, are used to provide a screening-level risk assessment that is intended to allow risk assessors and managers to rapidly determine whether a site poses an ecological risk. The purpose of a screening-level risk assessment is to detect whether a significant ecological risk exists at the site. A risk does not exist unless: (1) the stressor (a physical, chemical, or biological entity [EPA, 1992]) can cause one or more adverse effects and (2) it co-occurs with or contacts an ecological component long enough and at sufficient intensity to elicit the identified adverse effect (EPA, 1994). In Step 2, risks are estimated by comparing maximum analyte concentrations with screening-level ecotoxicity benchmarks. This step, which is also part of Decision Point 3 shown in Figure 2, is used to evaluate whether or not the site preliminary screening is adequate to determine if an ecological threat exists (EPA, 1994).

Subsequent steps of the EPA methodology are more detailed and are aimed at refining risk estimates and determining site-specific cleanup goals. If none of the PCOCs are present at ecotoxic concentrations, the site is considered to present a negligible or *de minimis* risk and a more detailed quantitative risk assessment is not warranted (EPA, 1994).

The ERAM was specifically designed as guidance for conducting ERAs at RFETS. This site-specific guidance contains the necessary information to accomplish the first two steps in the EPA guidance. Specific RFETS guidance documents include:

- *ERAM Technical Memorandum No. 2 (TM2), Sitewide Conceptual Model* (DOE, 1995b), which helps identify environmental stressors and the potentially complete exposure pathways that will become the focus of the ERA (DOE, 1995b); and

  ERAM Technical Memorandum No. 3 (TM3), Ecological Chemicals of Concern Screening Methodology (DOE, 1995c), which describes a tiered screening process for identifying chemicals at potentially ecotoxic concentrations.

Tier 1 describes the screening process used in the background comparison stage. Tier 2 describes the actual screening of PCOCs and comparison to benchmarks with the subsequent generation of hazard quotient (HQ) values. The HQ is the result of the exposure estimate divided by the benchmark. The screen is conservative because it assumes that receptors are

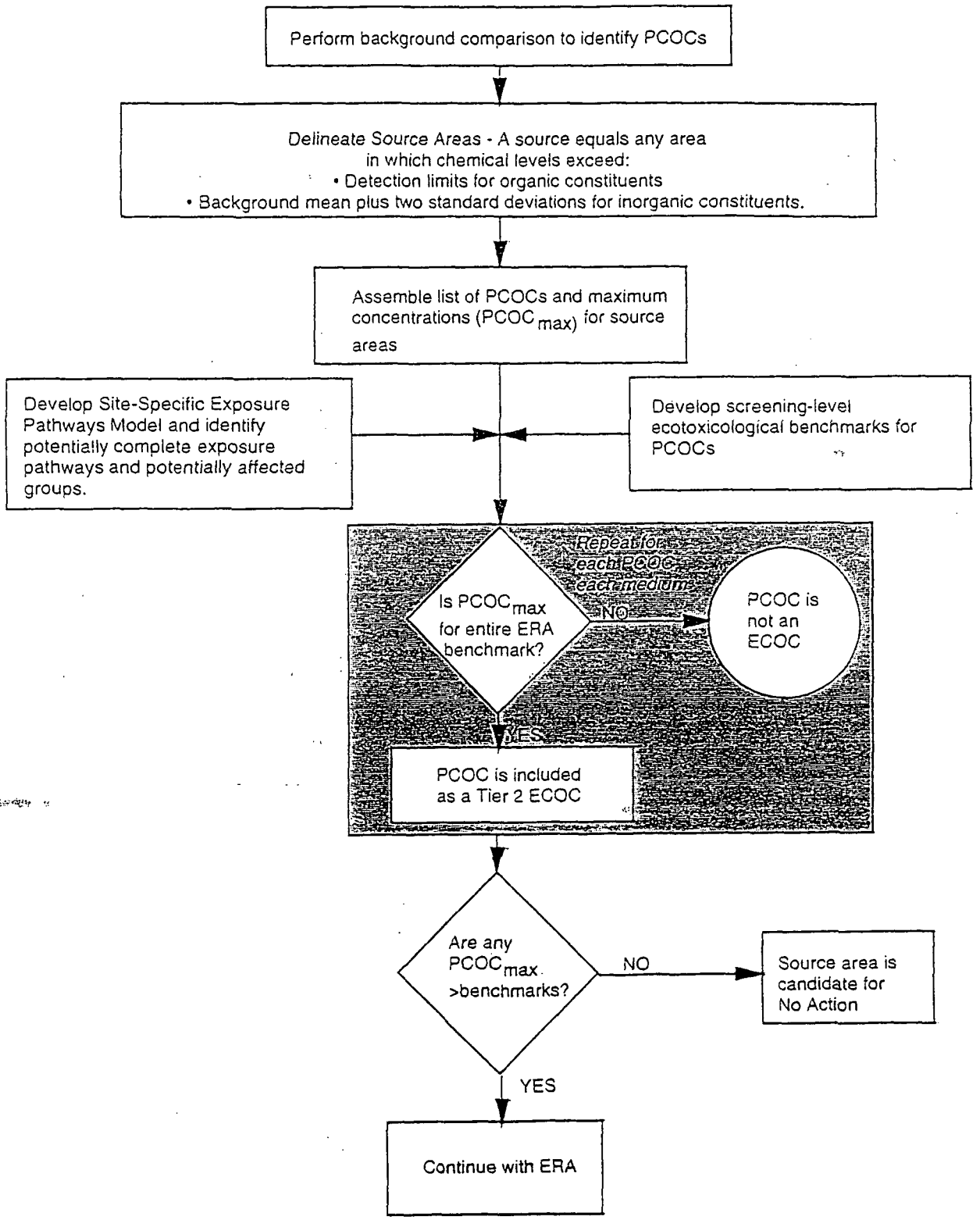

Figure 5. Screening-Level ERA

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continuously exposed to the highest concentrations detected and evaluates potential toxicity to individuals and not adverse effects to populations or communities.

At the screening stage, the HQ approach is used to estimate risk by comparing site-specific estimates of exposure to ecotoxicological benchmarks. It should be assumed that the receptor will spend all of its time in areas of maximum PCOC concentrations. Also, the PCOC content of all food consumed by the receptor will be assumed to be equal to the maximum concentration for that particular medium. (Note: The HQ used in the ERA is different than the HQ used in the HHRA to report noncarcinogenic effects of chemicals on humans.)

If the HQ for a PCOC is greater than 1, then that analyte is identified as a potential ecological chemical of concern (ECOC) and is subject to further analysis in Tier 3. However, if HQs for each of the PCOCs for a source area are below 1, the screen indicates that none of the PCOCs are present at potentially ecotoxic concentrations and should not be subjected to further analysis in Tier 3.

In summary, an IHSS or SA that fails to pass any of the screening criteria described in this section will be grouped with similar IHSSs or SAs into an AOC and will undergo a CERCLA baseline risk assessment (HHRA and/or ERA), as described in Section 2.4.

2.4 CERCLA Baseline Risk Assessment

CERCLA, as implemented by the NCP, establishes the overall approach for determining appropriate remedial actions at Superfund sites. The overall mandate of the Superfund program is to protect human health and the environment from current and potential threats posed by uncontrolled hazardous substance releases. To support this mandate, EPA developed the *Risk Assessment Guidance for Superfund* (RAGS) (EPA, 1989a and 1989b), which addresses both the human health and ecological risk assessments in Volumes I and II, respectively. Within remedial investigation reports, baseline risk assessments provide an evaluation of the potential threat to human health and the environment in the absence of any

remedial action. The baseline risk assessment (BRA) therefore consists of an HHRA and an ERA.

The risk assessment methodology used at RFETS has been jointly adapted to this site by DOE, EPA, CDPHE, and EG&G from EPA guidance. RFETS guidance to the HHRA process is provided in the *Human Health Risk Assessment Methodology for RFETS* (EG&G, 1995). The methodology for conducting an RFETS ERA is based on the *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments* (EPA, 1994). Site-specific guidance for conducting ERAs is provided in *Ecological Risk Assessment Methodology for Rocky Flats Environmental Technology Site* (Vertucci *et al.*, 1995).

2.4.1 Human Health Risk Assessment Methodology

As established in Section 2.3, an AOC must undergo a BRA if it does not pass through the risk-based screen. Figure 6 briefly outlines the steps taken in conducting an HHRA, which consist of the following elements:

- Identifying chemicals of concern (COCs)
- Developing exposure scenarios
- Describing fate and transport models
- Calculating intake factors
- Conducting a toxicity assessment
- Conducting a risk characterization
- Analyzing uncertainty in the HHRA
- Documenting human health risks in the BRA.

An RFI/RI report includes both a summary of risks for a site and a list of recommendations. However, the final decisions on whether or not a site will be recommended for NFA or if a remedial action is warranted is made by the risk managers from DOE, EPA, and CDPHE. Below are a few guidelines in making these risk-management decisions.

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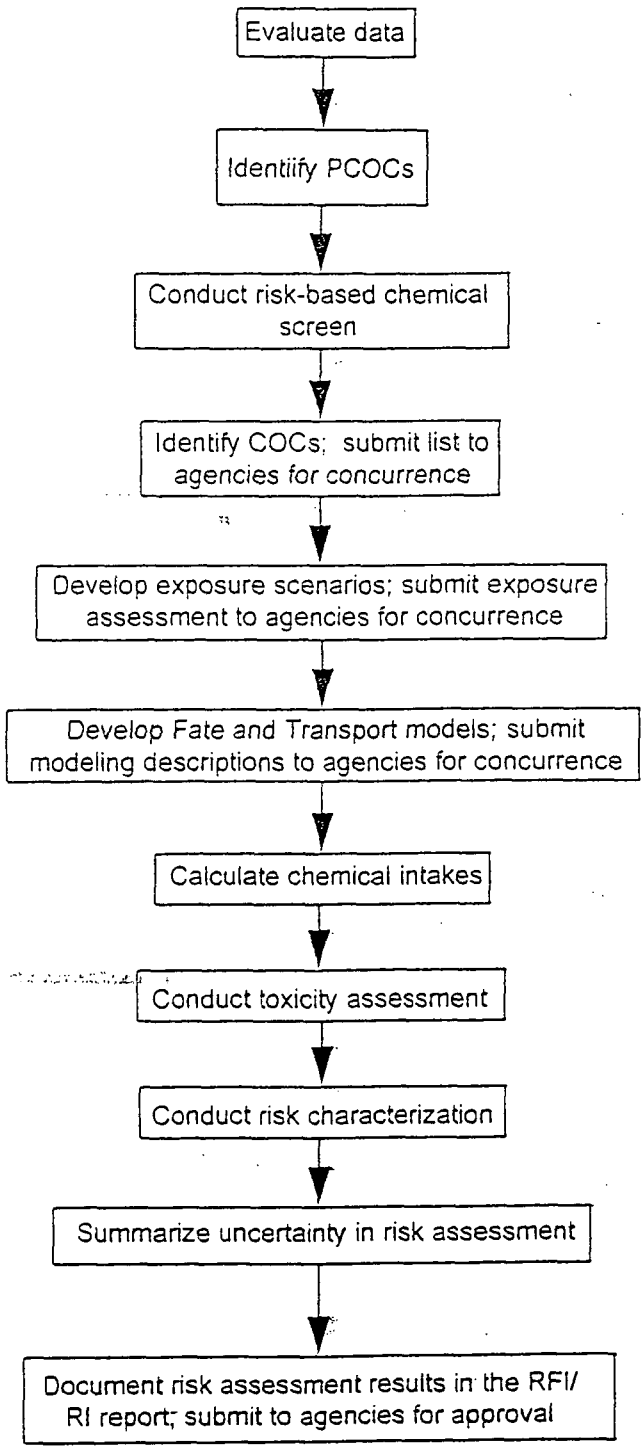

Figure 6. Human Health Risk Assessment Process

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1. An IHSS, AOC, or OU is a candidate for an NFA decision if the carcinogenic risk estimated using the exposure factors for the appropriate receptor (e.g., open-space recreational user, office worker, construction worker, resident) is 10E-6 or below and the noncarcinogenic hazard index (HI) is below 1.

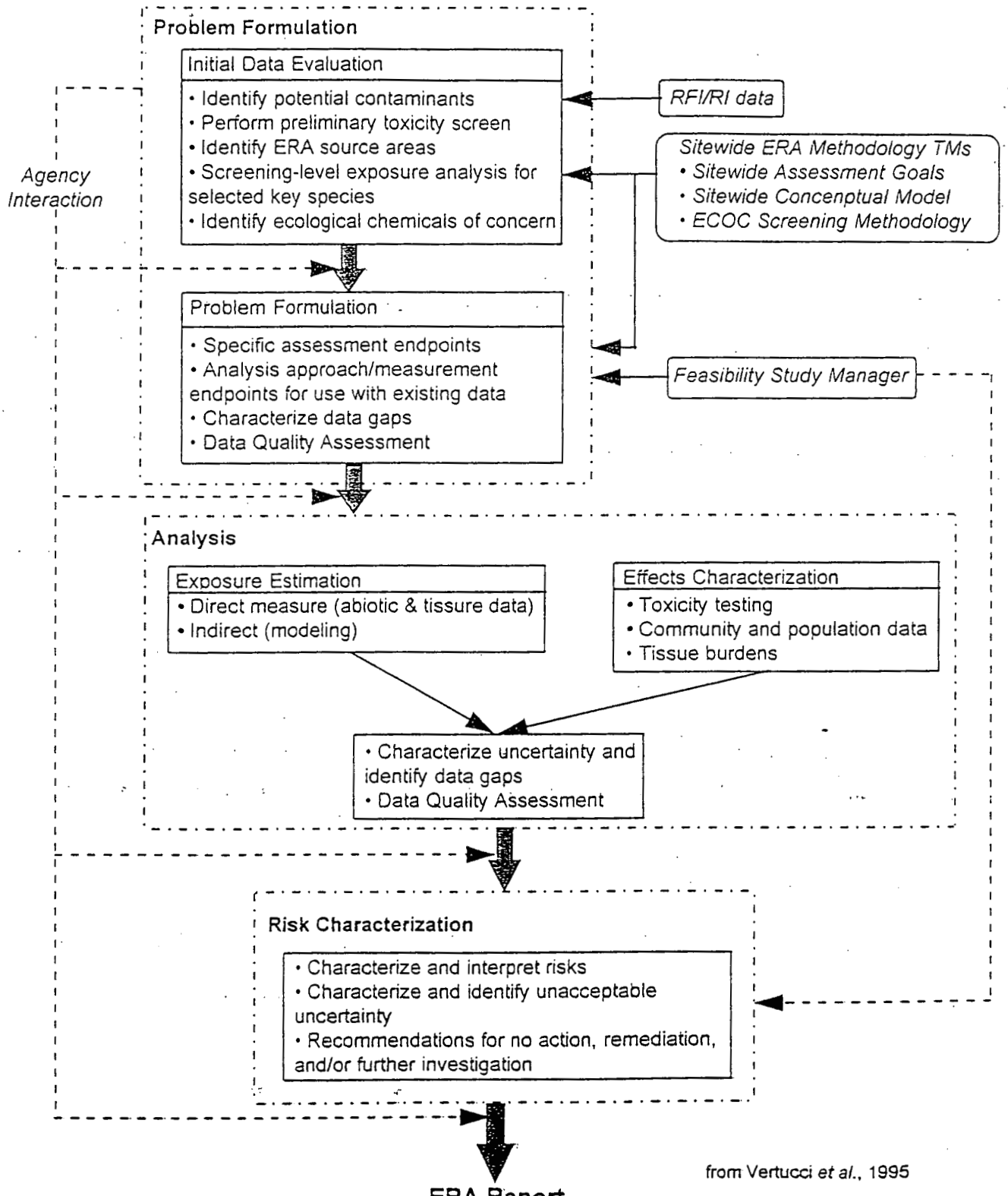
2. An IHSS, AOC, or OU may become a candidate for an NFA decision if the carcinogenic risk estimated, using the exposure factors for the appropriate receptor (e.g., open-space recreational user, office worker, construction worker, resident) is between 10E-6 and 10E-4, the noncarcinogenic HI is between 1 and 10, and neither risk managers nor stakeholders can provide nonrisk-based justification that a remedial action is warranted.

OSWER Directive 9355.0-30 (EPA, 1991b) provides guidance to support the above criteria:

> "Generally, where the baseline risk assessment indicates that a cumulative site risk to an individual using reasonable maximum exposure assumptions for either current or future land use exceeds the 10^{-4} lifetime excess cancer risk end of the risk range, action under CERCLA is generally warranted at the site. For sites where the cumulative site risk to an individual based on reasonable maximum exposure for both current and future land use is less than 10^{-4}, action generally is not warranted, but may be warranted if a chemical specific standard that defines acceptable risk is violated, or unless there are noncarcinogenic effects or an adverse environmental impact that warrants action. A risk manager may also decide that a lower level of risk to human health is unacceptable and that remedial action is warranted, for example, there are uncertainties in the risk assessment results. Records of Decision for remedial actions taken at sites posing risk within the 10^{-4} to 10^{-6} risk range must explain why remedial action is warranted."

2.4.2 Ecological Risk Assessment Methodology

If data from a given IHSS or source fail to pass a Tier 2 ecological evaluation (HQ >1 for any analyte), the data are evaluated using a Tier 3 ERA screen, which is basically equivalent to the concentration/toxicity screening conducted during the HHRA. A Tier 3 ERA is a much more comprehensive evaluation of exposure pathways and a more accurate method for estimating exposure than a Tier 2 screening-level ERA. The Tier 3 exposure estimation includes methods that account for factors which modify the frequency, duration, and intensity of contact between a receptor and the contaminated media. Tier 3 evaluation results in a list of chemicals that are subjected to more detailed analysis in the ecological risk characterization.



from Vertucci *et al.*, 1995

Figure 7. Ecological Risk Assessment Process at RFETS

3.0 NFA DECISION DOCUMENTATION

The ultimate purpose of NFA decision documentation is to provide the basis for a final CAD/ROD. However, an NFA status will have a significant impact on activities at a site. Therefore, an efficient mechanism for implementing NFA decisions has been sought that provides both long- and short-term benefits. Perhaps the most expedient existing process for implementing NFA decisions is through IHSS updates to the HRR. The HRR is already required by Section I.B.5 of the IAG and until recently has been updated on a quarterly basis. Although currently slated for annual updates, there should be enough flexibility to change the frequency of the HRR updates as needed.

Among other purposes, these updates serve as a basis for issuing soil disturbance permits, obtaining waste determinations, and determining the appropriate level of personal protection equipment for work in an IHSS. Therefore, the HRR updates are an ideal forum for concurring on NFA decisions, tracking IHSS status, and communicating IHSS information (e.g., information for waste determinations required by EPA and CDPHE). The HRR update format includes a description of the release event, complete physical and chemical description of the constituents released, responses to the events, fate of the constituents released, and a reference section. Additionally, signature lines for DOE, EPA, and CDPHE concurrence are provided in the HRR updates and immediately upon approval, as documented by the HRR concurrence signatures, the updates are incorporated into the HRR. The process for updating the HRR has been developed through negotiations and document reviews from DOE, EPA, and CDPHE.

A recommendation for an NFA decision for an IHSS, or group of IHSSs (i.e., agreed upon by DOE, EPA, and CDPHE as part of the NFA process described herein) is therefore presented to DOE, EPA, and CDPHE as an update to the HRR. Documentation justifying the NFA decision must accompany an NFA recommendation to support the HRR update, and ultimately, a CAD/ROD determination. Characterization of sites, including the evaluation of data to determine risk, is usually included within RFI/RI reports. For those sites evaluated within an RFI/RI Report or a Letter Report (i.e., for those IHSSs that pass the CDPHE conservative screen), additional NFA justification documentation is not necessary and the supporting

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documentation will be incorporated into the HRR update by reference, or appended, as necessary. For those sites not evaluated as part of an RFI/RI, NFA justification must be prepared to present an evaluation of existing information and data to support a scientifically and legally defensible NFA decision. This supporting documentation will be included in the HRR update as an attachment or appendix.

NFA justification documentation is prepared to support NFA decisions on IHSSs for which a (1) source evaluation has determined a lack of contaminant source, (2) background comparison has indicated a lack of contaminant source, and (3) future screening-level risk evaluation has indicated no risk is present. Depending upon the IHSS being evaluated, supporting documentation will vary in the type, quantity, and quality of information and data. The NFA working group must determine whether or not available data are necessary and sufficient to perform a given process evaluation that must be made for each site. Appropriate guidance (e.g., EPA/CERCLA, CDPHE/CHWA, IAG) is available to help determine if necessary and sufficient data are available to perform background comparisons and/or a risk-based screening of chemicals. An evaluation of data quality should be performed prior to using data and the results of that evaluation should be included as part of the documentation to ensure that the data quality objective process (generally presented in the OU work plan or sampling and analysis plan) is used during the investigation and documented properly.

An example of the types of information to be included as backup information is presented in Table 1. This sample table of contents can be modified, as necessary, to meet site-specific needs. It is also intended that all justification documentation be as brief as possible, including only the necessary and sufficient information required to support a scientifically and legally defensible decision.

The NFA decisions approved in the HRR updates are intended to be "place keepers". An IHSS can be placed on hold until the NFA working group agrees that initiating the administrative process (Proposed Plan, Closure Plan, CAD/ROD, RCRA Permit Modification, etc.) for IHSS closure is beneficial. The administrative process under CERCLA would be initiated with the preparation of a Proposed Plan, which may recommend closure of several IHSSs in one

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Table 1
Generalized Information Requirements for NFA Justification Documentation

1.0 INTRODUCTION
- 1.1 Purpose of Document
- 1.2 Background Information

2.0 FIELD INVESTIGATION
- 2.1 Site Investigation Objectives, including data quality objectives
- 2.2 Site History and Available Data
- 2.3 Investigation Activities
- 2.4 Data Quality and Usability

3.0 PHYSICAL CHARACTERISTICS
- 3.1 Surface Features
- 3.2 Geology
- 3.3 Hydrogeology
- 3.4 Ecology

4.0 NATURE AND EXTENT OF CONTAMINATION
- 4.1 Source Evaluation
- 4.2 Site Conceptual Model
- 4.3 Background Comparison
- 4.4 Nature and Extent of Contamination

5.0 EVALUATION OF RISKS
- 5.1 Risk-based Screening of Chemicals
- 5.2 Summary of Baseline Risk Assessment

6.0 NFA JUSTIFICATION

7.0 SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

8.0 REFERENCES

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LIST OF FIGURES
LIST OF APPENDICES

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CAD/ROD. Proposed Plans can be developed for individual sites, groups of sites, OUs and unrelated sites, depending upon the timing or benefit of any given closure or closures being pursued.

For IHSSs that have interim status under RCRA, the closure process is defined within correspondence to DOE from CDPHE (CDPHE, 1992). Per CDPHE guidance, public comment requirements were to be included as part of a combined IM/IRA and Closure Plan document. Although for NFAs an IM/IRA may not be required, a Closure Plan could still be required for those IHSSs that are designated as RCRA units. In this case, it may be possible to combine the Closure Plan with the HRR update. The benefits of combining these documents may warrant further consideration by CDPHE.

It is noted that in cases where IHSSs overlap, both IHSSs must meet the NFA criteria in order for closure of their respective geographical area to be pursued via the administrative process described above. The NFA status of an overlapping IHSS may still be documented with an HRR update, but the IHSS must be identified within the HRR update as overlapping with another IHSS which has or has not been accepted as having NFA status. This process will ensure that the area of IHSS overlap is still considered when the HRR is utilized for soil disturbance permits, waste determinations, personal protective equipment, and so forth. In addition, HRR updates can continue as required by the IAG and geographical areas may ultimately be closed.

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